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(12) UK Patent Application (19) GB (11) 2 137 212 A

(43) Application published 3 Oct 1984

(21) Application No 8307788

(22) Date of filing 22 Mar 1983

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(51) INT CL³
C08J 3/20 C08L 9/08 (C08L 9/08 93/04)

(52) Domestic classification
C3L DF
C3M 132 133 141 152 168 L
C3W 115 203 205 213 219
U1S 1368 C3L C3M

(56) Documents cited
EP A 0050226 EP A 0025004

(58) Field of search
C3L
C3M

(54) Preparation of tackified SBR polymer adhesive dispersions

(57) A tackified SBR polymer dispersion is prepared by co-polymerising styrene and butadiene (optionally with a third monomer), in the presence of a tackifier resin or rosin derivative, in a single step process and in the presence of an aqueous solution of an emulsifier and a polymerisation initiator.

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SPECIFICATION

Tackified synthetic rubber dispersions

This invention relates to synthetic rubber adhesive dispersions and in particular to stable modified aqueous styrene-butadiene based adhesive dispersions for use as pressure sensitive adhesives.

Acrylic based adhesive dispersions have been described in British patent specification No. 1257940 in the name of the British Oxygen Company Limited. It is already known that suitable styrene-butadiene copolymers or terpolymers (which contain small amounts of other monomers) may be modified to produce many satisfactory adhesive formulations by blending with organic derivatives of rosin acids and alcohols or synthetic resins. In this way the properties of the finished adhesive compound are formulated for specific applications. In the case of a pressure-sensitive label or tape adhesive these materials may modify tack, adhesion and cohesive strength, rendering it suitable for use on a wider variety of substrates.

When dealing with aqueous dispersion systems however, it is usual to add the resin or rosin derivative to the polymer emulsion in one of two ways either:–

(a) the tackifier resin is first emulsified and the resulting dispersion is then blended with the polymer emulsion to produce the finished adhesive or

(b) the tackifier resin is melted and/or dissolved in a suitable solvent at high concentration and the resulting solution blended with the polymer emulsion. A final water addition is then made to adjust the solids and viscosity of the final adhesive.

Although method (a) is the simpler technique, there are only a very limited number of resin dispersions suitable for this process, also, method (b) tends to produce a superior dispersion with better adhesive properties – due to better homogeneity.

This invention consists in a process for the preparation of a stable modified polymer adhesive dispersion, comprising forming a mixture containing;

(a) styrene at a level of 10% to 45% by weight of total active solids.

(b) butadiene at a level of 40% to 90% by weight of total active solids

(c) other monomers, at levels of 0 to 20% by weight of total active solids, chosen from acrylonitrile, methyl methacrylate, vinyl acetate, isoprene or an alkyl acrylate having 3 to 8 carbon atoms in the alkyl radical, or any polar acrylic monomer.

(d) a synthetic tackifier resin or a rosin derivative at a level of 5 to 55% of the total active solids; and polymerising monomers (a) (b) and optionally (c) in the presence of tackifier (d), in a single-step process, in the presence of an aqueous solution containing one or more emulsifiers and polymerisation initiators.

Examples of suitable polar acrylic monomers under (c) are acrylic acid, methacrylic acid, acrylamide, hydroxyethylacrylate and octyl acrylate. Rosin derivatives for use in the process of the invention include fully hydrogenated rosin acids or disproportionated rosin acids; esters of fully hydrogenated rosin acids derived from polyhydric alcohols such as glycerol, pentaerythritol, triethylene glycol and esters derived from dibasic acids such as phthalic acid and hydroabietyl alcohol. Suitable rosin acids for hydrogenation or disproportionation are those derived from tall oil, gum rosin or wood rosin, the commonest hydrogenated rosin acid being tertrahydroabietic acid.

Suitable synthetic resins may include any of the following:–

(i) Pure monomer resins such as Kristalex, Piccotex (Hercules trade mark) etc.

(ii) Aliphatic, aromatic, polyterpene or terpene/phenolic type resins such as Escorez (Esso), Imprez (ICI) Piccolyte (Hercules), Wingtack (Goodyear), Nirex (Rheichold) etc.

(iii) Plasticising/tackifying resins of the polybutene or polyisobutylene type such as Hyvis (BP) or Vistanex (Esso).

The emulsifier can be any of the surface tension depressants well known in emulsion polymerisation. Among those that may be mentioned are the ethylene oxide derivatives of alkyl phenols, fatty acids and alcohols, sodium lauryl sulphate or sulphated or sulphonated ethylene or polypropylene oxide derivatives or alkyl phenols, fatty acids or fatty alcohols and rosin soaps. Suitable polymerisation initiators are water soluble inorganic peroxy compounds such as hydrogen peroxide, alkali metal persulphates and ammonium persulphate. Alternatively catalyst systems of the redox type employing combinations of oxidising and reducing agents may be used. Generally chain transfer agents such as carbon tetrachloride and dodecyl mercaptans may be used to control the molecular weight.

The polymerisation reaction is carried out at pressures and temperatures typically used for SBR emulsion manufacture.

The dispersions are preferably prepared by dissolving the resin or rosin derivative in the mixture of the monomers and then polymerising the mixture in the presence of the emulsifier such that the resulting aqueous polymeric dispersion contains from 25–75% by weight of the polymeric material. The dispersions may be made by first mixing the monomers with an

aqueous solution of the emulsifier, or by adding an aqueous solution of the emulsifier separately during the course of polymerisation.

If desired the aqueous polymeric dispersion amy also contain one or more additives such as pigments, colour agents, anti-foaming agents and fungicides.

A typical final composition that may be used to form a general purpose permanent pressure sensitive adhesive for labels or tapes would comprise by weight:–

A. Styrene 15%
Butadiene 35%
Rosin Derivative 50%
} of active solids

or

B. Styrene 10%
Butadiene 35%
Rosin Derivative 50%
Other Monomer 5%
} of active solids

CLAIMS

1. A process for the preparation of a stable modified polymer adhesive dispersion, comprising forming a mixture containing;
(a) styrene at a level of 10% to 45% by weight of total active solids.
(b) butadiene at a level of 40% to 90% by weight of total active solids.
(c) other monomers at levels of 0 to 20% by weight of total active solids, chosen from acrylonitrile, methyl methacrylate, vinyl acetate, isoprene or an alkyl acrylate having 3 to 8 carbon atoms in the alkyl radical, or any polar acrylic monomer,
(d) a synthetic tackifier resin or a rosin derivative at a level of 5 to 55% of the total active solids; and polymerising monomers (a) (b) and optionally (c) in the presence of tackifier (d) in a single-step process, in the presence of an aqueous solution containing one or more emulsifiers and polymerisation initiators.

2. A process according to claim 1 wherein the polar acrylic monomer (c) is chosen from acrylic acid, methacrylic acid, acrylamide, hydroxyethyl acrylate and hydroxypropyl acrylate.

3. A process according to claim 1 or claim 2, wherein the acrylate having from 3 to 8 carbon atoms in the alkyl radical is butyl acrylate or octyl acrylate.

4. A process according to any preceding claim, wherein the rosin derivative is a fully hydrogenated rosin acid, or a disproportionated rosin acid, an ester of a fully hydrogenated rosin acid derived from a polyhydric alcohol such as glycerol, pentaerythritol, or triethylene glycol or an ester derived from a dibasic acid, such as phthalic acid, and hydroabietyl alcohol.

5. A process according to any one of claims 1 to 3 wherein the rosin derivative is tetrahydroabietic acid.

6. A process according to any preceding claim wherein the component (d) is a synthetic aliphatic, aromatic polyterpene, terpene phenolic, or a polybutene or polyisobutylene resin.

7. A process according to any preceding claim wherein the emulsifier is chosen from an ethylene oxide derivative of an alkyl phenol, a fatty acid or an alcohol, sodium lauryl sulphate or a sulphated or sulphonated ethylene or propylene oxide derivative of an alkyl phenol, a fatty acid or a fatty alcohol.

8. A process according to any preceding claim wherein the polymerisation initiator is a water soluble inorganic peroxy compound.

9. A process according to claim 8 wherein the polymerisation initiator is hydrogen peroxide, an alkali metal persulphate or ammonium persulphate.

10. A process according to any one of claims 1–7 wherein the polymerisation initiator is a catalyst system of the redox type employing a combination of oxidising and reducing agents.

11. A process according to any preceding claim wherein the resulting aqueous polymeric dispersion contains from 25–70% by weight of the polymeric material.

12. A process according to any preceding claim wherein the aqueous polymeric dispersion is made by first mixing the monomer mixture with an aqueous solution of the emulsifier.

13. A process according to any one of the claims 1 to 11, wherein an aqueous solution of the emulsifier is added to the mixture during the course of the polymerisation.

14. A process according to any preceding claim wherein one or more additives such as a pigment, colour agents, anti-foaming agents and fungicides are added to the aqueous polymeric dispersion.

15. A process for the preparation of a stable modified SBR adhesive dispersion substantially as described herein.

16. A stable modified SBR adhesive dispersion whenever prepared according to the process of any one of claims 1 to 15.

Printed in the United Kingdom for Her Majesty's Stationery Office, Dd 8818935, 1984, 4235.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.